A PHAENOLOGICAL NOTE ON THE FLORA OF THE VICINITY OF COLD SPRING HARBOR, N. Y.*

N. M. GRIER,
Dartmouth College,

AND

S. A. GREEN,
Maryville College.

In recent years interest in phaenological studies has been stimulated by the work of Sir Francis Darwin. In the first of of these studies of his on the British Flora, Darwin[1] could not correlate the first flowering of 231 species of these plants with the temperature factor. His observations in this case extended over the years 1917-18-19, and for the months of January to July inclusive of those years. In his next paper[2] he states, however, that the early flowering of the species in the years 1918 and 1920 must be connected with the relatively higher temperatures ruling in the spring of those two years. This paper gave observations upon 272 species over the period January to September during the years 1919-20. In a third paper,[3] Darwin remarks that it was not surprising for the flowering dates to be early in 1921, since the temperature had been above normal that year. Commenting upon his results from 233 species over the period November 1920 to September 1921, he observes that the rainfall during the period considered had been the smallest of the past 105 years in the British Isles. He remarks, "the connection of low rainfall with early flowering is probably to be ascribed partly to the quicker warming up of the dryer soil in the spring so that early growth would be promoted through the higher soil temperature, provided sufficient water is present for the needs of growth. In regard to early flowering as such it is well known that individual plants

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[1]1919. Darwin, Sir Francis. A Phaenological Study. New Phytologist 18:287-298.

[2]1921. *Ibid.* Studies on Phaenology, No. 2, 1920. New Phytologist 20:30-38.

[3]1922. *Ibid.* Studies on Phaenology, No. 3, 1921. New Phytologist 21:34-40.

growing in spots where the supply of water is soon exhausted produce a smaller bulk of vegetation and flower correspondingly earlier though of course less profusely than those growing in spots where water is available for a longer period."

Lyon[4] studied floral and meteorological records of the Hanover, N. H. district for the years 1917-21 inclusive. For the first and last years he was able to very definitely associate a cool temperature with late flowering while the remaining years also gave evidence in favor of the factor of temperature control on the flowering of plants. He made no attempt, however, to correlate these periods with the amount of precipitation which had occurred.

The records upon which our observations are based were made at the Biologocal Laboratory, Cold Spring Harbor, N. Y. in the summers of 1922-23-24 during the six weeks period in which the Laboratory was in session, between the last week of June and the second week in August. Many of the plants which bloom during the summer in that region may flower in the spring months, so for the purposes of accuracy we include in our observations only those species listed in Britton and Brown or Gray as blooming from June onward (Table I). Since in other cases our records were for only two of the three years considered, we have been forced to use as the basis of our tentative conclusions a comparatively small number of species—44 in all. In comparison, the number of species considered by Darwin over the same period in three years were 59, 51 and 50. The meteorological records used are those of the United States Weather Bureau Station at Roslyn, L. I., (Table II), which is comparatively near Cold Spring Harbor. While our results indicate that for each of these three years the majority of the flowers appeared in the weeks of July 8, 14 and 20, certain differences in the sequence apparently confirm the findings of Darwin and Lyon.

1922. If we compare the totals of the first four and the last three weeks of the observation period of this year with similar periods in 1923, we observe that certain species flowered later in 1922 than 1923. This was also the case in a number of other species not included in the list, because we obtained no records for them in 1924. It will be noticed from the accompanying table that 1922 was not nearly so warm as 1923 during the flowering period which fact brings out a slight correlation of

[4]1922. Lyon, C. J. A Phaenological Study in New England. Torreya 22:19-28.

time of flowering with the temperature. Although the temperatures of 1922 were largely above normal from January on, a greater number of subnormal temperatures as well as a

TABLE I.

Species	Earliest Date. Month Day†	June	July				August		
		27	8	14	20	26	1	7	13
1. Hemerocallis fulva	6–28	0	x*						
2. Lysimachia terrestris	6–28	x	0	*					
3. Rubus odoratus	6–30	x	*	0					
4. Leonurus Cardiaca	7–2		0	*		x			
5. Spartina glabra	7–2		0 x			*			
6. Spartina patens	7–2		0 x	*					
7. Verbascum Thapsus	7–3	0 *	x						
8. Agrimonia gryposepala	7–4		x	* 0					
9. Agrostis alba	7–4		* 0	x					
10. Arctium minus	7–4		*			x 0			
11. Asclepius syriaca	7–4		* 0 x						
12. Chrysopsis falcata	7–4		0 x		*				
13. Hypericum perforatum	7–4		x 0		*				
14. Lathyrus maritimus	7–4		* 0	x					
15. Melilotus alba	7–4		* 0 x						
16. Plantago maritima	7–4		0	*	x				
17. Rumex crispus	7–4		* 0		x				
18. Helianthus annuus	7–5		x	0	*				
19. Limonium carolinianum	7–5		x *	0					
20. Typha angustifolia	7–5		x	*		0			
21. Verbascum Blattaria	7–5		0 *	x					
22. Chimaphila maculata	7–6		x	0	*				
23. Circaea lutetiana	7–6		x	0	*				
24. Ligustrum vulgare	7–6		0	*	x				
25. Sericocarpus asteroides	7–6		x	0	*				
26. Linaria Cymbalaria	7–8		*	0	x				
27. Clethra alnifolia	7–9		0		x	*			
28. Nepeta Cataria	7–9		0	x	*				
29. Calluna vulgaris	7–10		*		0 x				
30. Impatiens biflora	7–10		*	x	0				
31. Cephalanthus occidentalis	7–11			x	0			*	
32. Sericocarpus linifolius	7–11			x	* 0				
33. Polygala polygama	7–11			x 0	*				
34. Amaranthus retroflexus	7–12			0			x	*	
35. Chenopodium album	7–12			0 x	*				
36. Oenothera muricata	7–12			*	0 x				
37. Verbena urticaefolia	7–12			x 0		*			
38. Mollugo verticillata	7–14			x	*	0			
39. Epipactis pubescens	7–15			x		*		0	
40. Centaurea Cyanus	7–17				0			x *	
41. Epilobium angustifolium	7–17			0	*	x			
42. Hypopitys americana	7–17			x	* 0				
43. Apocynum cannabinum	7–21				0 *	x			
44. Lobelia cardinalis	7–23				0	x	*		

†—x = 1922.
0 = 1923.
* = 1924.

TABLE II.

Roslyn, N. Y.

WEEK OR MONTH	NORMAL DAILY MEAN TEMPERATURE	DEVIATION FROM NORMAL DAILY MEAN TEMPERATURE		
		1922	1923	1924
	(1914–1924)			
January	29.48	— .69	+ .17	+1.11
February	28.88	+4.32	—3.48	—1.88
March	37.80	+3.30	—1.80	—1.40
April	48.19	+1.41	— .21	—1.90
May	58.50	+4.20	+ .30	—4.10
Total	.....	+12.54	—5.02	—8.17
	(1922, 1923, 1924)			
June 1–26	68.5	+ .9	+3.3	—4.2
June 27–July 8	69.7	+1.8	—1.0	— .9
July 9–14	72.5	— .4	+ .5	— .1
July 15–20	72.6	+ .9	+2.6	—2.5
July 21–26	72.7	— .8	+ .1	+ .6
July 27–August 1	70.0	— .3	+ .1	+ .2
August 2–7	73.5	—2.0	+2.6	— .8
Total	.....	+ .1	+8.3	—8.5

Roslyn, N. Y.

WEEK OR MONTH	NORMAL DAILY MEAN PRECIPITATION	DEVIATION FROM NORMAL DAILY MEAN PRECIPITATION		
		1922	1923	1924
	(1914–1924)			
January	4.23	—2.00	+3.28	+ .13
February	3.76	— .07	— .85	+ .40
March	3.22	+1.11	+1.02	—1.47
April	3.72	+ .26	— .72	+2.69
May	3.78	+ .45	—1.93	+1.79
Total	.....	— .25	+ .80	+3.54
	(1922, 1923, 1924)			
June 1–26	.19	+ .07	— .01	— .07
June 27–July 8	.15	+ .17	— .06	— .10
July 9–14	.15	— .11	— .15	— .06
July 15–20	.08	+ .09	— .03	— .07
July 21–26	.09	— .07	— .01	— .09
July 27–August 1	.08	+ .03	+ .03	— .07
August 2–7	.11	+ .12	— .06	— .07
Total	.....	+ .30	— .29	— .53

greater amount of precipitation occurred during the flowering season. In view of Darwin's suggestion that a low rainfall is usually associated with earlier flowering through a more rapid warming up of the soil, it seems plausible that the temperature in this case were insufficient under the conditions to have such an effect. Apparently then for this year, the low temperature abundant precipitation during the growing season together and the delayed the time of flowering with the evidence favoring the precipitation as the factor tending to nullify the accumulative effects of the higher temperatures of the preceding months.

1923. Study of the records for this year by the method previously described indicates that the majority of the flowers in this year bloomed earlier than those of 1922 and 1924. During the summer of 1923 there occurred the highest temperatures of the growing seasons of the three years considered; hence we have a positive correlation with the temperature factor. The precipitation during the growing season of this year is seen to be less than that of 1922. Since the season was neither as dry nor as cold as that of 1924, we should expect earlier flowering to characterize the year. The temperatures for this year were mostly above normal from January on, while the precipitation was above normal during the first five months only. If the number of cases really supplies sufficient evidence, this correlation checks quite well with Darwin's observation that not only higher temperatures but lower rainfall also are connected with earlier flowering.

1924. A very clear tendency toward late flowering is shown in this year through comparison of the totals of the last four weeks of the three years and this is correlated with predominantly lower temperatures. But the late flowering is correlated with lower precipitation during the flowering period. If lower rainfall is usually associated with earlier flowering through rapid warming up of the soil, this apparently contradictory instance may be explained by the fact that the temperature of the 1924 season was too low to have the usual effect in warming up the soil. Apparently then, the temperature was a stronger determinant of the time of flowering for this year than the precipitation.

In conclusion, then, it is evident that the time of flowering is determined by the prevailing temperature; this, in turn, is modified by the amount of precipitation during the growing season.